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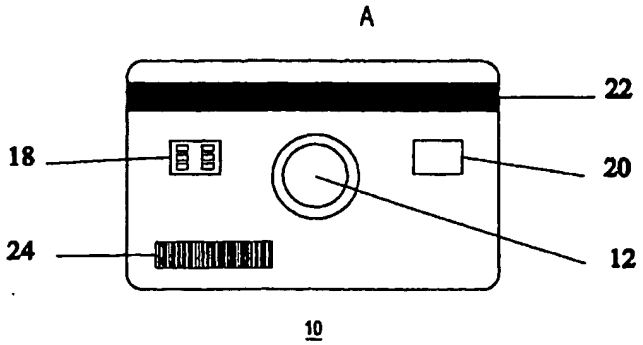

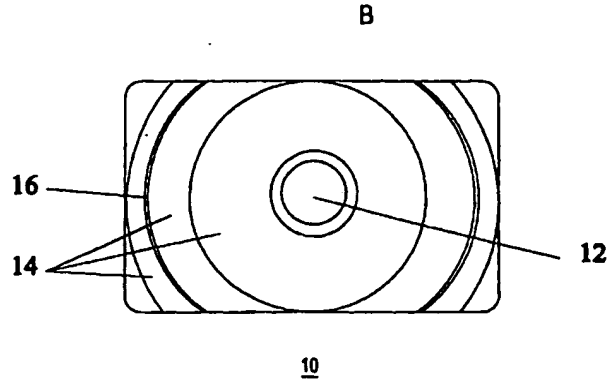

(57) Abstract: A reader/recorder for reading and writing data from/to a storage device (10) having multiple storage areas. The multiple storage areas include at least two of an optical medium storage area (14), a contact-type integrated circuit (IC) (18), a contactless-type IC (20), a magnetic strip (22), and a bar code (24). The reader/recorder further enables the storage device to be turned over so as to read optical information stored on a plurality of sides thereof (Figs 1A and 1B).

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APPARATUS AND METHOD FOR READING/WRITING DATA FROM/TO A STORAGE DEVICE HAVING MULTIPLE STORAGE AREAS

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus and method for reading/writing data from/to a storage device having multiple storage areas. Such an apparatus or method may enable the storage device to be turned over so as to read optical information stored on a plurality of sides thereof.

Low-capacity magnetic strip data storage cards, such as credit or debit cards, are ubiquitous. Such cards have been used for storing limited identification information for performing transactions. For example, the magnetic strip of a debit card may be used to store identification information for a debit account of the cardholder. To perform a transaction, a merchant may use a card reader to retrieve the identification information from the magnetic strip, and send the identification information, along with a personal identification number ("PIN") entered by the cardholder, to a central system through a network connection, whereupon the central system would access the account according to the identification information and PIN to determine whether the account is valid for such transaction.

In recent years, cards containing an integrated circuit ("IC"), also known as "Smart Cards," have been introduced. Such cards include a microprocessor for performing logic functions such as security logic, encryption, and so forth. As a result, smart cards are advantageous over magnetic strip cards in that the security of information stored therein is vastly superior. Additionally, smart cards may enable more personalized and/or sensitive information (e.g., account information, medical history information, and the like) to be stored therein, thus allowing more flexibility in performing transactions. For example, instead of accessing a central system for information on a debit account, account details may be stored in a smart card itself. As a result, the validity of a transaction may be determined by simply accessing the secured

account information stored in the smart card without the need for a network connection to the central system.

Given the added security of a smart card, more and more information can be stored therein. However, existing smart cards provide for only limited storage capacity. Thus, there is a need for high capacity data storage that is fast and convenient for use on a smart card. Furthermore, there is a need for apparatuses with the capability of reading/writing data from/to such high capacity data storage.

OBJECTS AND SUMMARY OF THE INVENTION

The present invention was made in consideration of the above problem and has as an object the provision of an apparatus for reading/writing data from/to a storage device having multiple storage areas, including a high capacity storage area.

It is another object of the invention to provide an apparatus capable of turning the storage device over so as to read optical information stored on a plurality of sides of the storage device.

Other objects and advantages of the invention will in part be obvious and will in part be apparent from the specification and the drawings.

An aspect of the present invention is to provide a card reader for reading a card, which includes a relatively large optical storage area, with a relatively fast access time. The data stored in the optical storage area may be encrypted and an encryption key for decrypting such data may be provided in a storage area on the same card or another card. The card reader of the present invention, thus, may also include a reader for retrieving such an encryption key. For optimizing the access time of the optical storage area, rotating Digital Versatile Disc ("DVD") or multi-layer or Compact Disc ("CD") technology may be used.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the invention, reference is made to the following description and accompanying drawing(s), wherein like reference numerals denote like elements and parts, in which:

Figures 1A and 1B illustrate views of a storage device/card;

Figure 2 illustrates a reading/writing apparatus according to an embodiment of the present invention;

Figure 3 illustrates the apparatus of Figure 2 with a number of components included therein;

Figure 4 is a diagram for illustrating communication between the storage device/card and the inventive apparatus;

Figure 5 is a flow chart for illustrating communication between the storage device/card, and a second input of the inventive apparatus;

Figure 6 is a flow chart for illustrating communication between one storage area within the storage device/card and a first input of the inventive apparatus;

Figure 7A illustrates a 180-degree turn over device having a motorized input with a slide forward according to an embodiment of the present invention;

Figure 7B illustrates the 180-degree turn over device having the motorized input with the slide in a rear/working position;

Figure 8A illustrates a 180-degree turn over device without a motorized input focusing on a laser sled assembly with a slide in a forward position according to an embodiment of the present invention;

Figure 8B illustrates the 180-degree turn over device without the motorized input focusing on the laser sled assembly with the slide in a rear position;

Figure 9A illustrates a 180-degree turn over arm opened and in a forward position with a media spindle in a standby position according to an embodiment of the present invention;

Figure 9B illustrates the 180-degree turn over arm clamped in the working position with the media spindle in the standby position;

Figure 9C illustrates the 180-degree turn over clamped in the working position with the media spindle engaged and in a working position;

Figure 10A illustrates a 180-degree turn over arm in the position shown in Figure 9B;

Figure 10B illustrates the 180-degree turn over arm clamped in the working position with the turn over arm rotated 180 degrees with the media spindle in the standby position according to an embodiment of the present invention;

Figure 10C illustrates the 180-degree turn over arm clamped in the working position with the turn over arm rotated 180 degrees with the media spindle engaged in working position;

Figures 11A and 11B illustrate the two storage areas of a device/card according to an alternative embodiment of the present invention and the contents thereof; and

Figures 12A and 12B illustrate an inventive device/card and a possible arrangement of the contents thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figures 1A and 1B illustrate first and second sides of a storage device 10 (hereinafter "storage device" shall be interchangeable with "card"), which contains multiple storage areas, in accordance with an embodiment of the invention. These storage areas may include any two or more of an optical medium storage area 14, a contact-type ("contact") IC 18, a contactless-type ("contactless") IC 20, a magnetic strip 22, and a bar code 24. The storage areas may be located on either the first or second side of card 10, and contact IC 18 and/or optical medium storage area 14 may be removably attached to card 10. Although the storage areas are located in respective positions in Figures 1A and 1B, the position of contactless IC 20 along with other storage areas may be placed at other positions in card 10.

Storage device 10 may conform to a so-called ID-1 (identification card) format and, as such, may have a substantially rectangular outer shape with a length of approximately 85.6 mm and a width of approximately 54 mm, which is similar to that

of a typical credit card. Alternatively, storage device 10 may conform to so-called ID-000, ID-00, ID-0, ID-2 and ID-3 formats. Additionally, storage device 10 may include an opening 12 adaptable for receiving a spindle of an optical recording and/or reproducing apparatus (e.g., apparatus 50 shown in Figure 2), which will be described in further detail below. Opening 12 may have a diameter of approximately 15 mm, which is similar to that used in CDs or DVDs. As a result, an apparatus, such as that of Figure 2, may read data in CD or DVD type formats in optical medium storage area 14. Further, storage device 10 may have one or more ridges 16 which may be utilized for alignment or registration during an initialization process by such recording and/or reproducing apparatus. Alternatively, ridges 16 may be omitted and the recording and/or reproducing device may be configured to utilize the outer boundaries of storage device 10 for such alignment or registration purposes.

As shown in Figure 1B, optical medium storage area 14 may extend to the ends of card 10 as noted by these three sections designated by 14. However, given the substantially rectangular shape of storage device 10, data may be stored in optical medium storage area 14 in an interrupted manner, i.e., the curved tracks in CD or DVD format in the outer (non-circular) sections of storage area 14 may be discontinuous. This interrupted data storage of optical medium storage area 14 is also shown in Figures 11A, 11B, and 12B, which will be discussed in further detail below. In addition, the circular inner section of optical medium storage area 14 may be removable from storage device 10.

An apparatus 50 for reading and/or writing data from and/or into storage device 10 according to an embodiment of the present invention is illustrated in Figures 2-4. As shown in Figure 2, apparatus 50 may include an open/close button 51, a first input 52, a tray 53, and a second input 54. Card 10 may be inserted into a slot of first input 52. When fully inserted in first input 52, the end of card 10 may protrude slightly to allow easy removal by hand once authentication is completed.

Referring now to Figure 3, upon verifying correct alignment/position of card 10, apparatus 50 may read any one or any combination of the storage areas of card 10 via a

contact IC reader 72, a contactless IC reader 61, a magnetic strip reader 70, and/or a bar code reader 71 for authentication. As shown in Figure 4, a contactless IC reader 63 (which may be the same as contactless IC reader 61) may include a receiver 64, a transmitter 62, and an antenna 60. Upon activation, transmitter 62 generates and transmits an RF signal through antenna 60 for reception by contactless IC 20. Upon receiving the transmitted RF signal, contactless IC 20 may be energized and transmit a data signal which may be received at receiver 64 by way of antenna 60. Alternatively, first input 52 may use automatic ejection, which causes partial ejection of card 10 following processing, allowing a user to manually remove card 10. This would be advantageous in that it would not allow a user to withdraw card 10 from apparatus 50 during processing, which may otherwise cause card failure (not allowing the proper shutdown sequence, interruption of read/write procedures, etc.). Contactless IC 20 may have its own power source (not shown), which may increase communication speed between contactless IC 20 and reader 61 or 63. The power source may be, but is not limited to, capacitive or inductive transmission via couplings. Magnetic strip reader 70 preferably reads any combination of tracks of magnetic strip 22 on card 10.

The data read from contact IC 18, contactless IC 20, magnetic strip 22, and/or bar code 24 may include identification information that identifies a particular individual, decrypting information for decrypting data stored in optical medium storage area 14 (Figure 1B), which may be encrypted, and so forth.

Storage device 10 may also be inserted into second input 54 by use of tray 53 whereupon apparatus 50 may read data from optical medium storage area 14 (Figure 1B) by use of an optical reader, such as that illustrated in Figure 4. Additionally, data from contactless IC 20 may also be read after storage device 10 is inserted into second input 54. The shape of tray 53 for second input 54 may have a shape in association with card 10 or any other shape suitable for reliable operation. Or, in the case of a 180-degree turn over device according to an embodiment of the invention (as illustrated in Figures 10A, 10B, and 10C), a clamping technique may be used for receiving card 10

into apparatus 50. In such cases, card 10 may not need to include registration/alignment ridge 16.

It should be noted that although two contactless IC readers 61 and 63 are shown in Figure 4, apparatus 50 may instead use only one such reader. Further, contactless IC 20 may be read by contactless IC reader 61 or 63 provided storage device 10 is within a predetermined proximity to apparatus 50. For example, contactless IC reader 61 may be able to read data from contactless IC 20 if reader 61 is arranged in association with first input 52 and storage device 10 having contactless IC 20 is inserted into second input 54. As another example, reader 61 may be able to read data from contactless IC 20 if reader 61 is arranged within apparatus 50 and storage device 10 having contactless IC 20 is positioned within a predetermined distance of apparatus 50 even though it is not inserted into either of first and second inputs 52 and 54.

It is noted that the two inputs 52 and 54 of the invention may be disposed in any configuration having a relative proximity to each to allow ease of use. These positions may include, but are not limited to, inputs 52 and 54 being adjoined side by side in a lateral position, or second input 54 being above first input 52.

Referring back to Figure 3, apparatus 50 may further include a sled motor unit 82, a tray motor 87, a laser drive unit 86, open/close button 51, and a spindle 56.

As previously indicated, the data stored in optical medium storage area 14 may be encrypted. In such situation, storage device 10 may be initially inserted in first input 52 so that an encrypting key or information may be obtained from one of contact IC 18, contactless IC 20, magnetic strip 22, or bar code 24. An encrypting key so obtained may be stored in a memory such as a flash memory 66. Afterwards, storage device 10 may be inserted into second input 54, whereupon the encrypted data may be reproduced therefrom and decrypted using the stored encrypting key.

In addition to reading data from storage device 10, second input 54 and the associated optical reader may be utilized to read data from other types of storage media, such as CD-I, CDV, CD-ROM, CD-R, CD-RW, DVD 5, DVD 9, DVD 10, DVD-R, DVD-RW, DVD-ROM, and so forth. Furthermore, apparatus 50 may be adaptable to

write data to a storage medium, such as a CD-R, CD-RW, DVD-R, DVD-RW; contactless IC 20, and so forth.

Referring back to Figures 3 and 4, upon verification within first input 52, tray 53 of second input 54 opens, and card 10 may be placed into tray 53. Tray 53 is returned to apparatus 50 by pushing tray 53 by hand or by pushing button 51 which activates motor drive unit 80, bringing tray 53 fully into an operating position. Alternatively, second input 54 may be accessed via an opening door or plate (not shown) directly above the operating position of card 10 (or an alternate optical medium), where opening 12 (centrally located hole within the medium) is pressed into place directly onto spindle 56, allowing said door/plate to be closed by hand. Thus, spindle 56 arrives into position within opening 12 of card 10 assuring proper alignment within input 54. Motor drive unit 80 engages spindle motor unit 78 causing spindle 56 to rotate, spinning card 10. Laser drive 86 is engaged for reading/writing of optical medium storage area 14 within card 10. The data is communicated to/from a Control/CPU unit 92 through an RF Amp/Data Demodulation/Data Modulation unit 88 and a Digital Data Processing unit 90. Additionally, it should also be noted that while it may be preferable to authenticate card 10 within first input 52 as described above, it is also possible to use second input 54 for verification purposes utilizing information contained within optical medium storage area 14.

The use of contactless IC 20 within card 10 may allow second input 54 to be used independently as a reader/writer as well as a substitute for first input 52 for verification purposes. Contactless IC reader 61 may be able to read data from contactless IC 20 if reader 61 is arranged within apparatus 50 and storage device 10 having contactless IC 20 is positioned within a predetermined distance of apparatus 50. For example, IC reader 61 may be able to read data from contactless IC 20 when card 10 containing contactless IC 20 is placed within second input 54 of apparatus 50 inasmuch as contactless IC 20 and contactless IC reader 61 are kept within the predetermined distance. Furthermore, reader 61 may be able to read data from contactless IC 20 when card 10 containing contactless IC 20 is not inserted into

apparatus 50 but is within the predetermined distance thereto. This may allow card 10 to simply be passed near apparatus 50 for verification of information or data located within contactless IC 20 provided that reader 61 and contactless IC 20 are kept within the predetermined distance. It is additionally possible for contactless IC 20 to continue communications, if necessary, while card 10 is in motion on CD spindle 56, thus allowing for reading/writing to both optical medium storage area 14 and contactless IC 20 simultaneously.

All data communications may be controlled by a processor/interface 120 through an interface unit 74. Data may also be communicated to/from a connected microprocessor or host computer through the input/output 76. In addition, a user input 94 and a display 152 may be connected to processor/interface 120 for providing user interface for controlling such data communications.

Furthermore, card 10 may be initiated in first input 52 strictly as an authentication device to allow a user to access second input 54 or information contained within a PC or similar device. Once second input 54 is made available to a user, card 10 containing verification may remain in first input 52 while action is carried out by second input 54 or by a connected microprocessor or host. For example, card 10 may be used as an encryption/decryption key within first input 52 to allow access to optical information contained on another card, CD, CD-R, or DVD.

Figure 5 illustrates a flow chart for an operation performed by apparatus 50 which involves reading data from optical medium storage area 14 and/or contactless IC 20 of storage device 10 when storage device 10 is received at second input 54. It is noted that data may also be written into contactless type IC 20 and/or optical medium storage area 14. Upon starting such operation at step S100, tray 53 opens at step S102. Card 10 is inserted at step S104, tray 53 closes at step S106, spindle 56 is engaged at step S108, and apparatus 50 internally checks for correct alignment and insertion of card 10 at step S110. If card 10 is not aligned properly with spindle 56, processing returns to step S102 where tray 53 re-opens to allow for adjustment and/or re-insertion (step S106). If card 10 is determined to be inserted properly at step S110, processing

proceeds to step S112 where apparatus 50 energizes contactless IC reader 63 (or 61). As shown by step S114, apparatus 50 then checks for the presence of contactless IC 20 in card 10.

If there is no contactless IC ("No"), processing proceeds to step S124 where apparatus 50 begins performing standard CD, CD-ROM, CD-R, DVD, multilayered optical information, etc., reading/writing functions by energizing media spindle 56. Processing then proceeds through steps S126, S128, and S130 where apparatus 50 energizes laser drive 86, moves laser sled motor unit 82 into initial position, and reads/writes data from/to optical medium storage area 14, respectively. RF amplification occurs at step S132, demodulation of data occurs at step S134, and data is processed at step S136 within processor/interface 120. It is noted that any encrypted data in optical medium storage area 14 may be indecipherable without contactless IC 20.

If apparatus 50 determines that card 10 includes a contactless IC, e.g. 20, at step S114 ("Yes"), processing proceeds to step S116 where apparatus 50 reads/writes data from/to IC 20. At step S118, authentication of IC 20 takes place through processor/interface 120. At step S122, if IC 20 is authenticated, processing proceeds to step S124. If, however, IC 20 is not authenticated, processing proceeds to step S102 where tray 53 is opened and storage device 10 is rejected. Data may be written to contactless IC 20 before either continuing data transfer to/from optical medium storage area 14, or completing a data transfer and proceeding to step S102. Furthermore, any encrypted data read from optical medium storage area 14 at step S130 may be decrypted using information from contactless IC 20 after authentication at step S122.

Figure 6 illustrates a flow chart for an operation performed by apparatus 50 which involves reading data from contact IC 18 of storage device 10 when storage device 10 is received at first input 52. Storage device/card 10 is inserted at step S140, contact IC reader 72 is energized at step S142. At step S144, contact IC 18 is authenticated by processor/interface 120 through flash memory 66. For authentication, display 152 may prompt a user for PIN, or a password, etc. Other authentication

methods may include, but are not limited to, biometrics, retinal scan, etc. Thus, at step S148, if contact IC 18 is not authenticated ("No"), processing is terminated as shown at step S150, and the user is prompted on display 152 to remove card 10 from apparatus 50. Alternatively, apparatus 50 may retain card 10 for confiscation.

If contact IC 18 is authenticated ("Yes"), data is read/written from/to contact IC 18, as shown at step S152. Data from contact IC 18 may be transferred through input/output 76 (shown in Figure 4) by processor 120 (shown in Figure 4) to be displayed on display unit 152 (shown in Figure 4). Input/output 76, as shown in Figure 4, may use one of many different forms of communication including, but not limited to, a modem, cable, wireless, direct connection (most notably, but not limited to, Small Computer System Interface ("SCSI"), Integrated Services Digital Network ("ISDN"), Universal Serial Bus ("USB"), firewire, serial, parallel, etc.) for communicating with any directly or remotely connected authorized processor. Once authentication is confirmed, it may be necessary to remove card 10 from first input 52 and input card 10 into second input 54, as shown at step S154, for processing, which may be similar to that described above and illustrated by Figure 5, as shown at step S156. If information is to be written into contact IC 18 and/or magnetic strip 22 thereafter, the user may be prompted to reinsert card 10 into first input 52.

In accordance with an embodiment of the invention, apparatus 50 may be configured to include a single input for receiving storage device 10 and performing reading and/or writing operations from and/or to optical medium storage area 14, contact IC 18, contactless IC 20, magnetic strip 22, and/or bar code 24. Apparatus 50 with a single input is illustrated in Figures 7A and 7B. As shown in Figures 10A, 10B, and 10C and described in further detail below, apparatus 50 may also be configured to turn card 10 over 180 degrees. Card 10 may contain optical information on both sides thereof, as shown in Figures 11A, 11B, 12A and 12B. For instance, if optical medium storage area 14 in Figure 1B is considered the "bottom" of card 10, there may be additional optical information located on the opposite or "top" side of card 10. Figures 11A and 11B, respectively, illustrate the "top" and "bottom" of card 10, which contains

optical information storage areas on both sides. Such top and bottom surfaces are opposite to each other. Figures 11A and 11B further illustrate the possibility for optical medium storage area 14 to extend beyond the boundaries 1104 and 1106, as dictated by the width 1108 of card 10, as previously discussed. The sections of optical medium storage area 14 near the edge, lengthwise, of card 10 may be read by apparatus 50 having an optical medium reader adaptable in reading the arced, discontinuous, tracks (e.g., tracks 1110 and 1115 in Figure 11A) therein. Figures 12A and 12B illustrate optical medium storage area 14 on top and bottom sides of card/device 10 that additionally contains magnetic strip 22, contact IC 18, as well as contactless IC 20.

Referring back to Figure 7A, a view of apparatus 50 for reading all data storage areas within card 10 in accordance with an embodiment of the invention is shown. Card 10 is inserted lengthwise into a card input 702. A bezel 711 ensures proper alignment upon insertion of card 10. Upon insertion, a 'card in' sensor 706 perceives the presence of card 10 allowing engagement of a tire transmission motor 708. A tire transmission gear 710 is adjoined to the shaft of motor 708. As the shaft of motor 708 rotates, tire transmission gear 710 spins. Transmission gear 710 is connected to a transmission shaft 716 which preferably contains a motorized tire 712 and 714 at opposite ends thereof. Motorized tires 712 and 714 revolve as a result of the turn from transmission shaft 716. Left motorized tire 714 and right motorized tire 712 are utilized for transportation purposes. As tires 712 and 714 rotate, card 10 is brought into apparatus 50. Magnetic tape heads 704 and 705 are positioned in such a way to read magnetic information (e.g., from magnetic strip 22) during conveyance. A 'card confirm sensor' 718 is located slightly inward from transmission shaft 716 to verify transport and presence of card 10. A 'card end sensor' 744 verifies that card 10 has indeed been carried fully into apparatus 50. Once card 10 has been carried fully into apparatus 50 via motorized tires 712 and 714, a top grip of turn over arm 800 (as shown in Figure 9A, and as will be described in further detail below) is ready to be clamped into working position while a spindle hub 720 is in a standby position. Upon clamping turn over arm 800 via a solenoid activated pin 801 (as shown in Figure 9B and as will be described in further

detail below), upper and lower card hubs 722 come directly into contact preferably within the inner stacking ring of card 10 and the slide of apparatus 50 travels to a rear/working position.

Figure 7B illustrates apparatus 50 in the rear/working position. This position is executed by a slide plate motor 724 turning a motorized pulley 726, which is attached to an idle pulley 728 preferably by a belt 730. Motorized pulley 726 and idle pulley 728 are mounted upon pulley blocks 750. Belt 730 is preferably connected to slide plate 732 by a belt/slide plate clamp 734. Clamp 734 is adjoined to both belt 730 and slide plate 732 to slide apparatus 50 into the front and rear positions. Apparatus 50 is kept from traveling too far in the front and rear position by a series of stops 736. Stops 736 exist in the front and rear/working positions and are located on right and left slide rods 738. A forward proximity sensor 746 and a rear proximity sensor 748 are preferably arranged slightly within the working range of slide plate 732 and just inside stops 736 to alert apparatus 50 that slide plate 732 is approaching or has reached the termination point of travel. Left and right slide bearings 740 slide along left and right slide rods 738 allowing easy transport of apparatus 50 from one position to the other. Left and right slide rods 738 are held in position by a series of slide rod supports 742 located outside of the purposely placed stops 736, allowing support for left and right slide rods 738 outside of the traveling range of the mechanism.

Upon reaching a working position, apparatus 50 has moved card 10 to a location where contact IC reader 72 is engaged in connection with contact IC 18 of card 10. Contact IC reader 72 is preferably mounted on a slide mechanism 756 allowing contact IC reader 72 to move, to some extent, in accordance with card 10 during transport. Once contact is made with contact IC reader 72 and information exchange takes place, reader 72 then retracts to avoid interfering with the rotation of card 10. In said working position, contactless IC reader 61 is able to read data from contactless IC 20 located within card 10 concurrently with contact IC reader 72 reading data of contact IC 18. This facilitates rapid data transfer, as data can preferably be read from multiple data storage areas simultaneously. In addition, contactless IC reader 61 may read/write

information from/to contactless IC 20 on card 10 while card 10 is rotated at high speed on spindle hub 720 for optical reading via a laser sled assembly (as shown in Figures 8A and 8B).

Figures 8A and 8B illustrate a laser sled assembly of apparatus 50 in a front position and a rear/working position, respectively. Spindle hub 720 is engaged into a working position through circular holes located on both the upper and lower portions of turn over arm 800 (as shown in Figure 9A). The holes in turn over arm 800 are purposely positioned to be synchronous with opening 12 of card 10, and specifically not to hinder access to opening 12. These circular holes or openings are purposely located to be directly above (in the case of the upper portion of turn over arm 800) and below (in the case of the lower portion of turn over arm 800) opening 12, which is preferably approximately 15 mm, in card 10. Additionally, the holes in turn over arm 800 are preferably slightly larger than the size of spindle hub 720 allowing complete access to opening 12 of card 10, while not hindering the rotation of spindle hub 720 or the effect thereof. Once spindle hub 720 is fully engaged and the spinning of card 10 has commenced, a laser 764 is energized and is allowed full access to read or write to/from optical medium storage area 14 within card 10 through a laser slot 760 within the upper and lower portions of turn over arm 800. Optical data within card 10 is arranged in a linear and circular fashion allowing laser 764 to follow in a continuous outwardly extending pattern. Slot 760 is extended to the dimension to allow laser 764 to travel the appropriate distance to read or write data beginning at the inner most ring of optical medium storage area 14 progressing outwardly to the end of the optical data stored therein. Laser 764 is conveyed to different positions within slot 760 in the following manner. The shaft of laser sled motor 762 is combined with a toothed gear (not shown). When the shaft of motor 762 is rotated, the gear on the end of the shaft drives the rotation of at least, but not limited to, two additionally connected gears 766. The last gear in the rotation is matched with a sled gear 770. Preferably, sled gear 770 is substantially rectangular. Sled gear 770 is attached to one of the two laser sled rods 772. When sled gear 770 is moved either in the outward or inward direction in relation

to optical medium storage area 14 on card 10, said laser sled rods 772 are correspondingly directed, causing laser 764 to remain in the proper position at all times. Left and right laser sled rods 772 are utilized to stabilize the laser sled assembly and allow free and continuous operation of laser 764.

Figure 9A illustrates a view of turn over arm 800 in an open and forward position with spindle hub 720 in a standby position. Slide plate 732 transports the apparatus between the front and rear working positions. Upper and lower portions of turn over arm 800 contain upper and lower card hubs 722, respectively. Spindle hub 720 is used for rotation of card 10 for optically reading optical medium storage area 14 using laser 764. A laser sled gear 770 for moving laser 764 along laser sled rods 772 allows laser 764 to follow the arrangement of optical medium storage area 14 on card 10 in a linear and circular fashion. End card sensor 744 is located on the upper portion of turn over arm 800 and end card sensor receiver 788 is located directly below on the lower portion of turn over arm 800 in order to verify a final position of card 10 before operation of apparatus 50. Solenoid activated pin 801 is arranged in such a manner to allow clamping of the upper and lower portions of turn over arm 800 upon arrival of card 10.

The clamping process may involve a pivot 774, an upper grip turn over arm slide 776, and a compression spring 778. Upper grip turn over arm slide 776 is connected to the pivot-side (back-end) of the upper portion of turn over arm 800 and contains a vertical slot to allow the end of the upper portion of turn over arm 800 to travel up and down (up=card is clamped, down=open/standby position). When the upper portion of turn over arm 800 is raised, the end connected to upper turn over arm slide 776 is in the lower position and compression spring 778 naturally holds arm 800 and arm slide 776 in the lower position. During clamping, pin 801 is ejected, forcing the back-end of the upper portion of turn over arm 800 up within upper grip turn over arm slide 776, forcing the working end of the upper portion of turn over arm 800 (which contains the upper card hub) down into a clamping position.

Figure 9B illustrates the upper and lower portions of turn over arm 800 clamped and in a working position with spindle hub 720 in the standby position. When pin 801 is released, spring 778 compresses again, and the back-end of the upper portion of turn over arm 800 is pulled down in upper grip turn over slide 776. This causes the clamp to cease and the card 10 is no longer held in place by clamping force.

Figure 9C illustrates the upper and lower portions of turn over arm 800 clamped and in the working position with spindle hub 720 in a working position. Once spindle hub 720 is engaged in the working position, it is then preferable for hub 720 to begin spinning. The spinning is controlled by encoder 780 and encoder wheel 782, which also count and control the rotation speed of spindle 720.

Figure 10A illustrates a view of the turn over arm 800 clamped in the working position, with spindle hub 720 retreated back into the standby position awaiting a 180-degree turn over of storage device 10.

Figure 10B illustrates a view of turn over arm 800 clamped in the working position, with card 10 and turn over arm 800 rotated 180 degrees. This is brought about by a rotation motor 784. A rotation motor plate 786 mounts rotation motor 784 to slide plate 732 at a 90-degree angle allowing clear operation for motor 784. Rotation motor 784 encompasses a shaft, which is connected to the lower portion of turn over arm 800. Upon activation of rotation motor 784, the motor shaft forces the rotation of the lower portion of turn over arm 800 and inverts the upper and lower portions of turn over arm 800, as shown in Figure 10B. This facilitates reading/writing from/to optical medium storage area 14 on the opposite side of card 10 without the need for removing card 10 by hand, turning it over and reinserting card 10 into apparatus 50. The automatic turn over of card 10 provided by the invention is such that the location of card 10 after a turn over is the same as the original working position. Opening 12 is located in the same position both horizontally and vertically as are the edges of card 10, etc.

Once the mechanism has rotated 180 degrees, spindle hub 720 engages once again to resume operation and this is illustrated in Figure 10C. The upper portion of turn over arm 800 encompasses the specifically dimensioned laser slot 760 (shown in

Figs. 7A and 8A) once again allowing laser 764 to read optical information on storage device 10. The operation continues as stated previously, with apparatus 50 being able to rotate card 10 repeatedly. Upon completion of communication processes, right and left card position sensors 802 and 804 (as shown in Figure 7A) allow apparatus 50 to position card 10 in such a way as to ensure proper orientation for card 10 to be ejected from apparatus 50 in the manner in which it was entered.

Although in the above-description of the present invention, specific devices and/or quantities thereof have been described, the present invention is not so limited and other devices and/or quantities may be utilized. For example, in addition to the types and number of storage areas used in the present storage device, other types of storage areas and/or numbers of storage areas may be used in the present storage device. In addition, card 10 described hereinabove may be used in other optical drives (e.g., a CD-Rom drive, etc.) if card 10 does not include any encoding and/or encryption involving storage areas other than optical medium storage area 14.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, because certain changes may be made in carrying out the above method and in the construction(s) set forth without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therein.

WHAT IS CLAIMED IS:

1. An apparatus for reading data from a storage device having a first storage area and a second storage area, in which one of said first and second storage areas is an optical storage area, said apparatus comprising:

first reading means for rotating said storage device and for optically reading data stored in the optical storage area while said storage device is rotated;

second reading means for reading data stored in the other of said first and second storage areas; and

means for turning said storage device from one of a first side and a second side to the other of the first and second sides.

2. An apparatus according to claim 1, wherein the first reading means and the second reading means are integrally arranged within said apparatus.

3. An apparatus according to claim 1, wherein the first reading means and the second reading means read the data stored in the first and second storage areas simultaneously.

4. An apparatus according to claim 1, wherein said first reading means includes means for reading data from at least one of a compact disc (CD), a digital versatile disc (DVD), and a CD-ROM.

5. An apparatus according to claim 1, wherein said second reading means includes means for reading data from at least one of a contact integrated circuit, a contactless integrated circuit, a magnetic strip-type area, and a bar code-type area.

6. An apparatus according to claim 1, wherein the optical storage area is located on one of the first and second sides of the storage device and the other of said first and second storage areas is located on the other of the first and second sides.

7. An apparatus according to claim 1, wherein the data stored in the optical storage area includes encrypted data, and said apparatus further comprises decryption means for decrypting said encrypted data.

8. An apparatus according to claim 7, wherein the data stored in the other of said first and second storage areas includes decryption data for decrypting said encrypted data.

9. An apparatus according to claim 1, wherein the data stored in the other of said first and second storage areas includes identification data, and the first reading means reads the data stored in the optical storage area only after the second reading means reads the identification data.

10. An apparatus according to claim 1, wherein the optical storage area is located on one of the first and second sides of the storage device and an additional optical storage area is located on the other of the first and second sides.

11. An apparatus according to claim 1, wherein the storage device has a length of approximately 85.6 mm and a width of approximately 54 mm.

12. An apparatus according to claim 1, wherein the optical storage area includes a circular portion and a non-circular portion and said first reading means reads data from the circular portion and the non-circular portion.

13. An apparatus for reading data from a storage device having a first storage area and a second storage area, in which one of said first and second storage areas is an optical storage area, said apparatus comprising:

first reading means for rotating said storage device and for reading data stored in the optical storage area while said storage device is rotated, in which the optical storage area includes a circular portion and a non-circular portion and in which said first reading means reads data from the circular portion and the non-circular portion; and

second reading means for reading the data stored in the other of said first and second storage areas.

14. An apparatus according to claim 13, wherein the first reading means and the second reading means are integrally arranged within said apparatus.

15. An apparatus according to claim 13, wherein the first reading means and the second reading means read the data stored in the first and second storage areas simultaneously.

16. An apparatus according to claim 13, wherein said first reading means includes means for reading data from at least one of a compact disc (CD), a digital versatile disc (DVD), and a CD-ROM.

17. An apparatus according to claim 13, wherein said second reading means includes means for reading data from at least one of a contact integrated circuit, a contactless integrated circuit, a magnetic strip-type area, and a bar code-type area.

18. An apparatus according to claim 13, wherein the optical storage area is located on one of a first side and a second side of the storage device and the other of said first and second storage areas is located on the other of said first and second sides.

19. An apparatus according to claim 13, wherein the data stored in the optical storage area includes encrypted data, and said apparatus further comprises decryption means for decrypting said encrypted data.

20. An apparatus according to claim 19, wherein the data stored in the other of said first and second storage areas includes decryption data for decrypting said encrypted data.

21. An apparatus according to claim 13, wherein the data stored in the other of said first and second storage areas includes identification data, and the first reading means reads the data stored in the optical storage area only after the second reading means reads the identification data.

22. An apparatus according to claim 13, wherein the storage device has a length of approximately 85.6 mm and a width of approximately 54 mm.

23. An apparatus according to claim 13, wherein the storage device includes first and second sides, and said apparatus further comprises means for turning the storage device from one of the first and second sides to the other of the first and second sides.

24. An apparatus according to claim 23, wherein the optical storage area is located on one of the first and second sides of the storage device and an additional optical storage area is located on the other of the first and second sides.

25. A method of reading data from a storage device having a first storage area and a second storage area, in which one of said first and second storage areas is an optical storage area, said method comprising the steps of:

rotating said storage device and optically reading data stored in the optical storage area while said storage device is rotated;

reading data stored in the other of said first and second storage areas; and

turning said storage device from one of a first side and a second side to the other of the first and second sides.

26. A method according to claim 25, wherein the first and second storage areas are read by devices integrally arranged within an apparatus.

27. A method according to claim 25, wherein the first and second storage areas are read simultaneously.

28. A method according to claim 25, wherein the optical storage area includes at least one of a compact disc (CD), a digital versatile disc (DVD), and a CD-ROM format.

29. A method according to claim 25, wherein the other of said first and second storage areas includes at least one of a contact integrated circuit, a contactless integrated circuit, a magnetic strip-type area, and a bar code-type area.

30. A method according to claim 25, wherein the optical storage area is located on one of the first and second sides of the storage device and the other of said first and second storage areas is located on the other of the first and second sides.

31. A method according to claim 25, wherein the data stored in the optical storage area includes encrypted data, and said method further comprises the step of decrypting said encrypted data.

32. An apparatus according to claim 31, wherein the data stored in the other of said first and second storage areas includes decryption data for decrypting said encrypted data.

33. A method according to claim 25, wherein the data stored in the other of said first and second storage areas includes identification data, and the data stored in the optical storage area is read only after the identification data is read.

34. A method according to claim 25, wherein the optical storage area is located on one of the first and second sides of the storage device and an additional optical storage area is located on the other of the first and second sides.

35. A method according to claim 25, wherein the storage device has a length of approximately 85.6 mm and a width of approximately 54 mm.

36. A method according to claim 25, wherein the optical storage area includes a circular portion and a non-circular portion and the step of optically reading data stored in the optical storage area includes reading data from the circular portion and the non-circular portion.

37. A method of reading data from a storage device having a first storage area and a second storage area, in which one of said first and second storage areas is an optical storage area, said method comprising the steps of:

rotating said storage device and reading data stored in the optical storage area while said storage device is rotated, wherein the optical storage area includes a circular portion and a non-circular portion and said step of reading data stored in the optical storage area includes reading data from the circular portion and the non-circular portion; and

reading the data stored in the other of said first and second storage areas.

38. A method according to claim 37, wherein the first and second storage areas are read by devices integrally arranged within an apparatus.

39. A method according to claim 37, wherein the first and second storage areas are read simultaneously.

40. A method according to claim 37, wherein the optical storage area includes at least one of a compact disc (CD), a digital versatile disc (DVD), and a CD-ROM format.

41. A method according to claim 37, wherein the other of said first and second storage areas includes at least one of a contact integrated circuit, a contactless integrated circuit, a magnetic strip-type area, and a bar code-type area.

42. A method according to claim 37, wherein the optical storage area is located on one of a first side and a second side of the storage device and the other of said first and second storage areas is located on the other of said first and second sides.

43. A method according to claim 37, wherein the data stored in the optical storage area includes encrypted data, and said method further comprises the step of decrypting said encrypted data.

44. An apparatus according to claim 19, wherein the data stored in the other of said first and second storage areas includes decryption data for decrypting said encrypted data.

45. A method according to claim 37, wherein the data stored in the other of said first and second storage areas includes identification data, and the data stored in the optical storage area is read only after the identification data is read.

46. A method according to claim 37, wherein the storage device has a length of approximately 85.6 mm and a width of approximately 54 mm.

47. A method according to claim 37, wherein the storage device includes first and second sides, and said method further comprises the step of turning the storage device from one of the first and second sides to the other of the first and second sides.

48. A method according to claim 47, wherein the optical storage area is located on one of the first and second sides of the storage device and an additional optical storage area is located on the other of the first and second sides.

FIGURE 1A

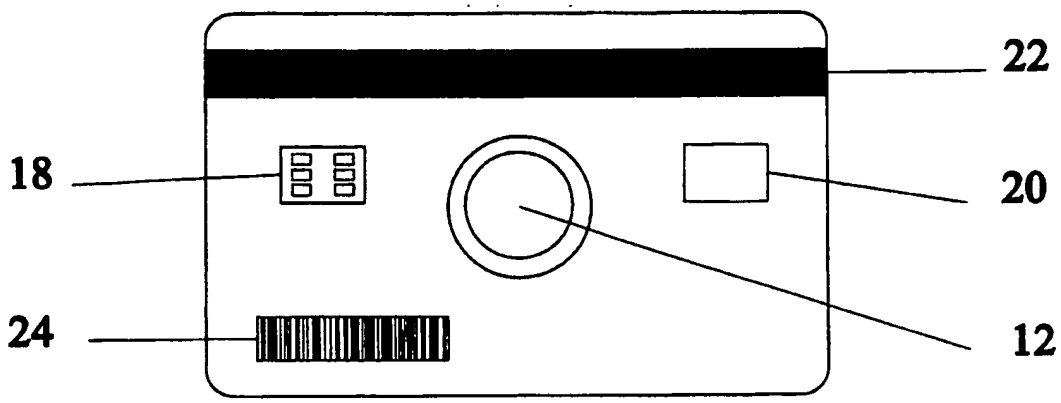

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FIGURE 1B

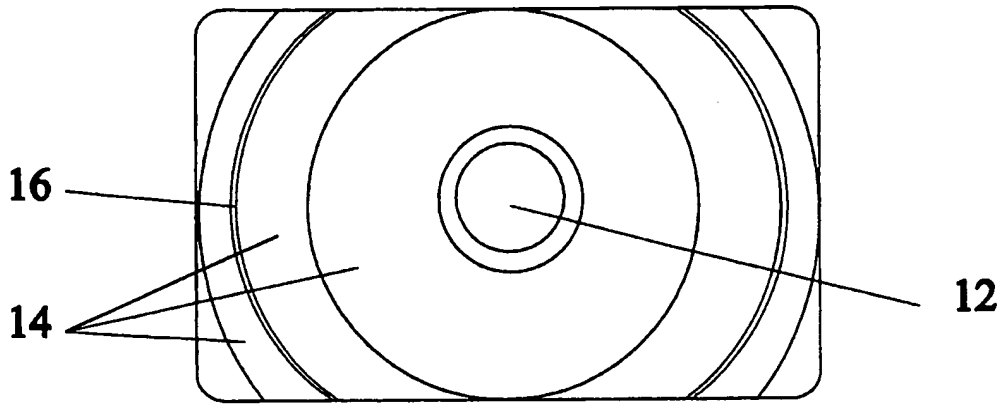

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FIGURE 2

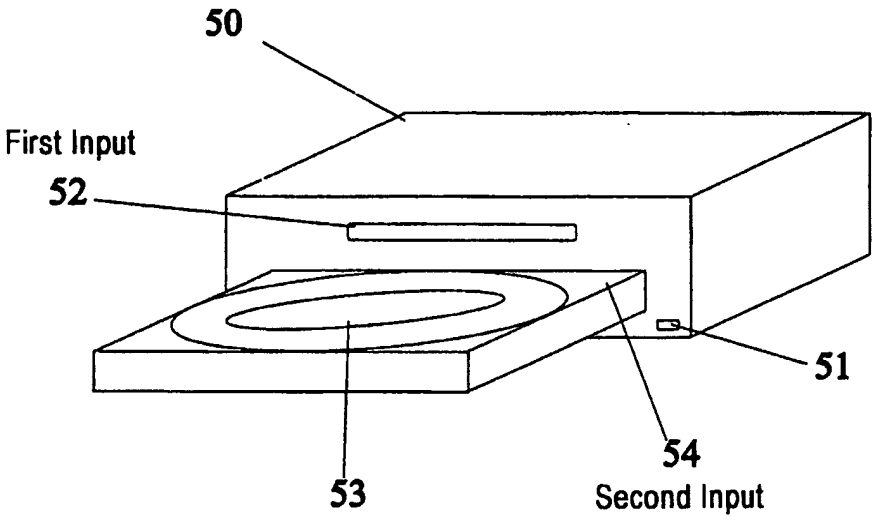


FIGURE 3

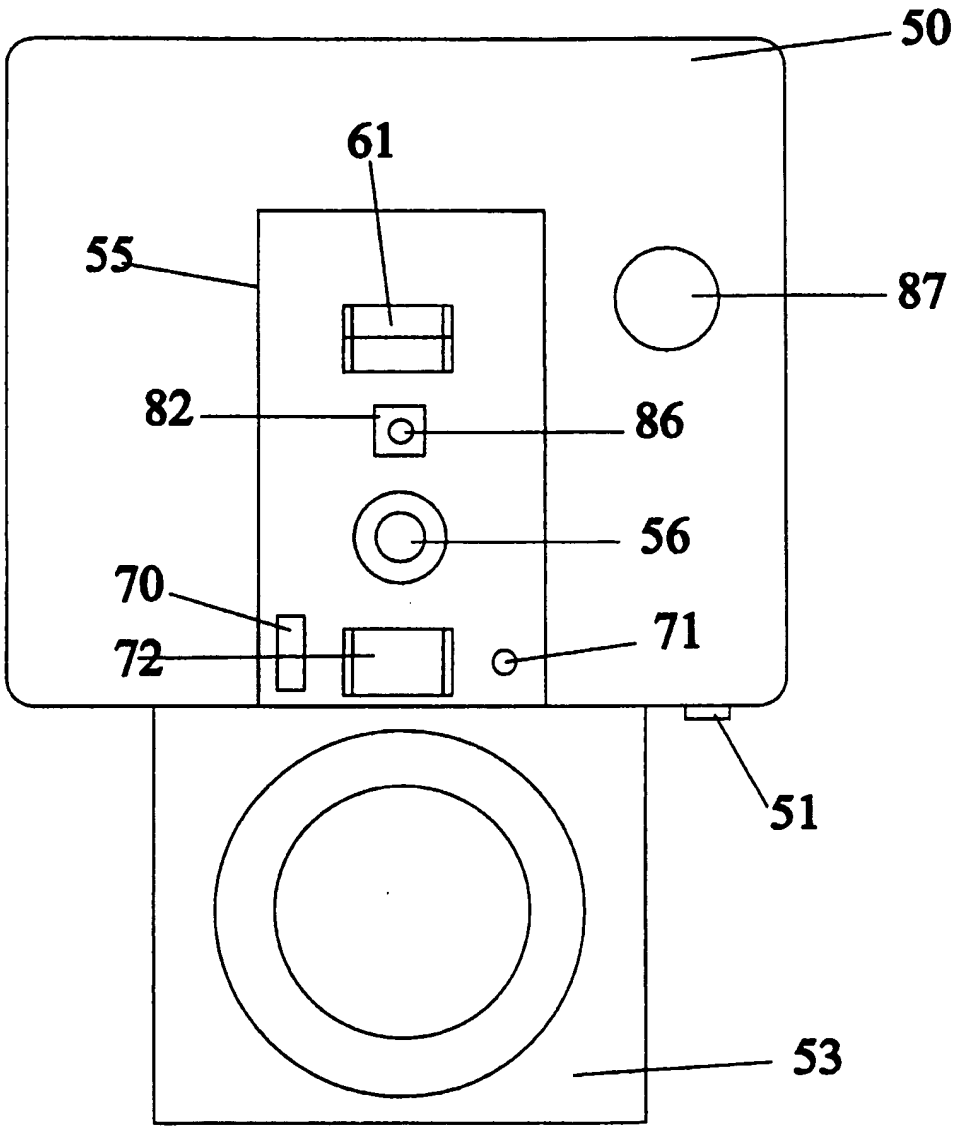


FIGURE 4

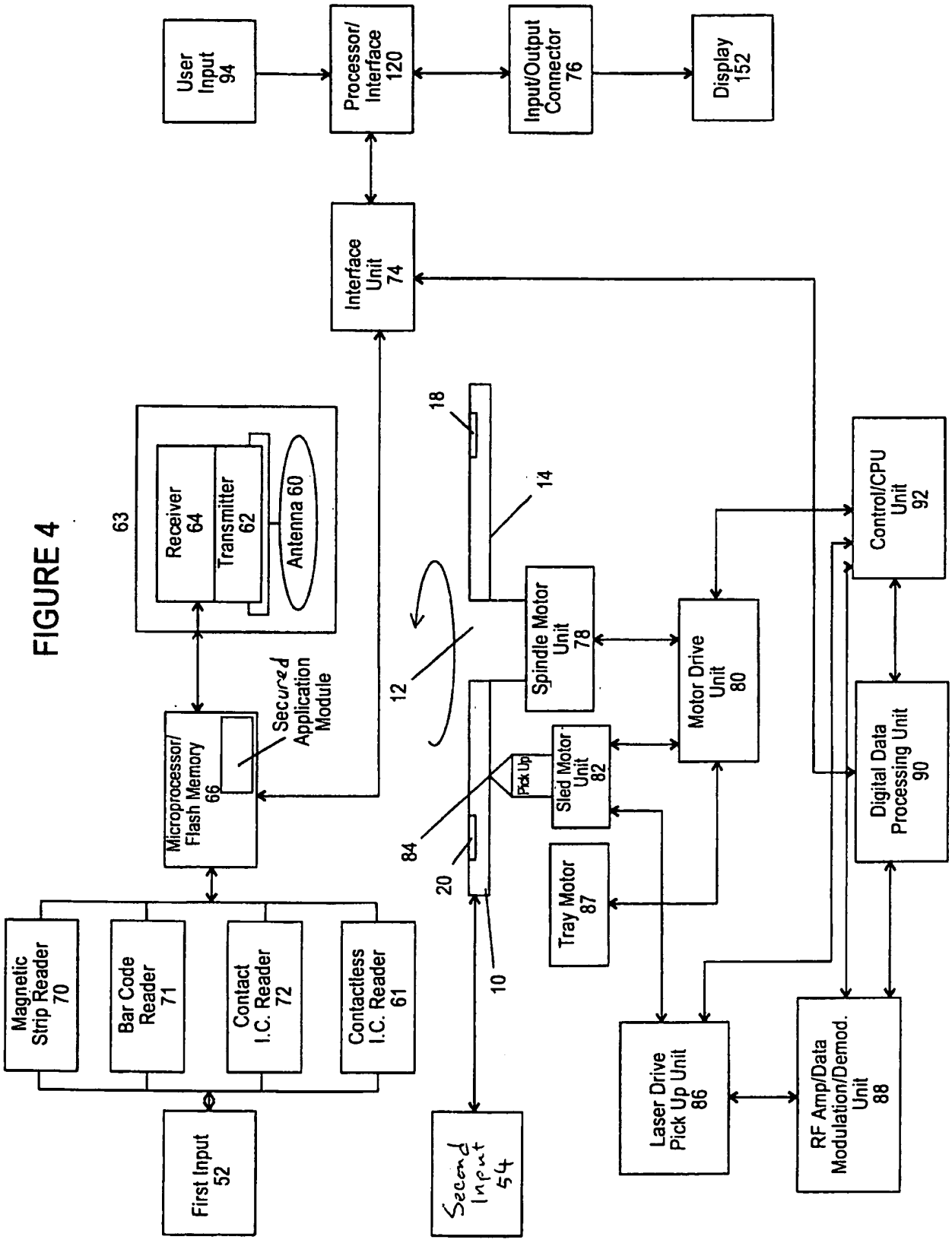
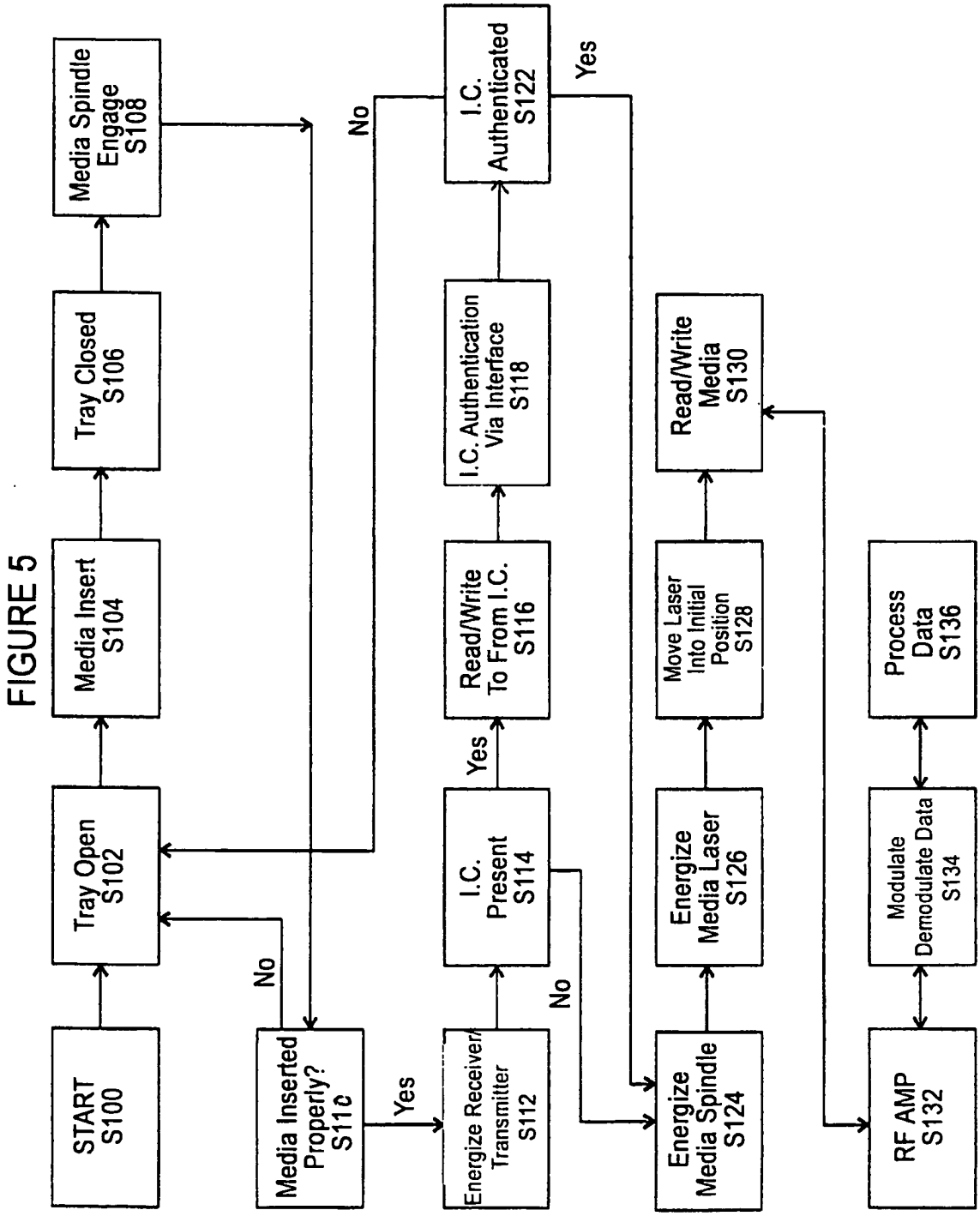

User Input 94
Processor/ Interface 120
Input/Output Connector 76
Display 152
Interface Unit 74
63
Receiver 64
Transmitter 62
Antenna 60
Secured Application Module
Microprocessor/ Flash Memory 66
18
14
12
Spindle Motor Unit 78
Motor Drive Unit 80
Control/CPU Unit 92
Digital Data Processing Unit 90
Pick Up
Sled Motor Unit 82
84
20
10
Tray Motor 87
Magnetic Strip Reader 70
Bar Code Reader 71
Contact I.C. Reader 72
Contactless I.C. Reader 61
First Input 52
Second Input 54
Laser Drive Pick Up Unit 86
RF Amp/Data Modulation/Demod. Unit 88

FIGURE 5


START S100
Tray Open S102
Media Inserted Properly? S110
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Yes
Media Insert S104
Tray Closed S106
Media Spindle Engage S108
Energize Receiver/ Transmitter S112
I.C. Present S114
No
Yes
Read/Write To From I.C. S116
I.C. Authentication Via Interface S118
I.C. Authenticated S122
No
Yes
Energize Media Spindle S124
Energize Media Laser S126
Move Laser Into Initial Position S128
Read/Write Media S130
RF AMP S132
Modulate Demodulate Data S134
Process Data S136

FIGURE 6

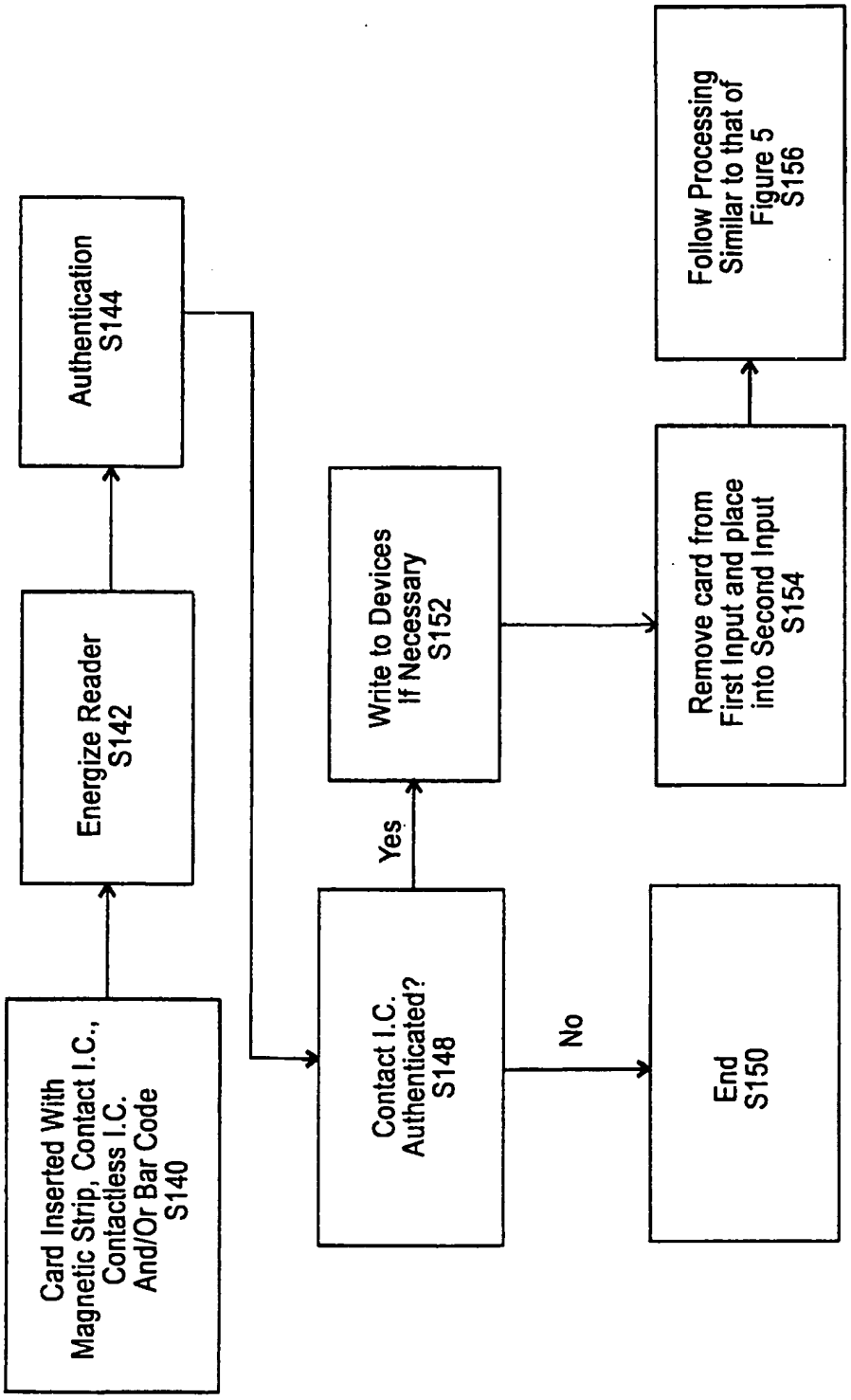
Card Inserted With Magnetic Strip, Contact I.C., Contactless I.C. And/Or Bar Code S140
Energize Reader S142
Authentication S144
Contact I.C. Authenticated? S148
Yes
No
Write to Devices If Necessary S152
End S150
Remove card from First Input and place into Second Input S154
Follow Processing Similar to that of Figure 5 S156

FIGURE 7A

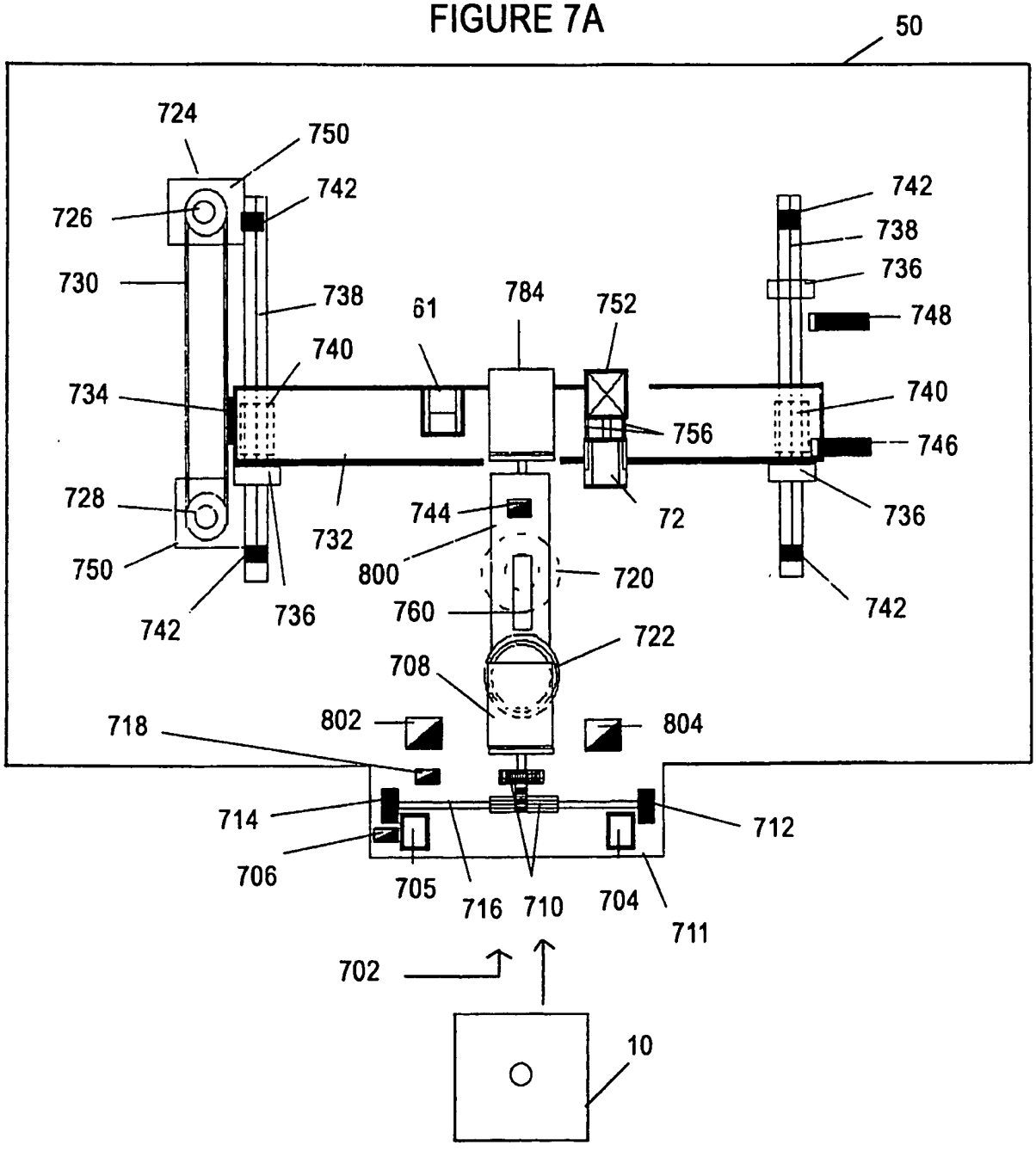
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FIGURE 7B

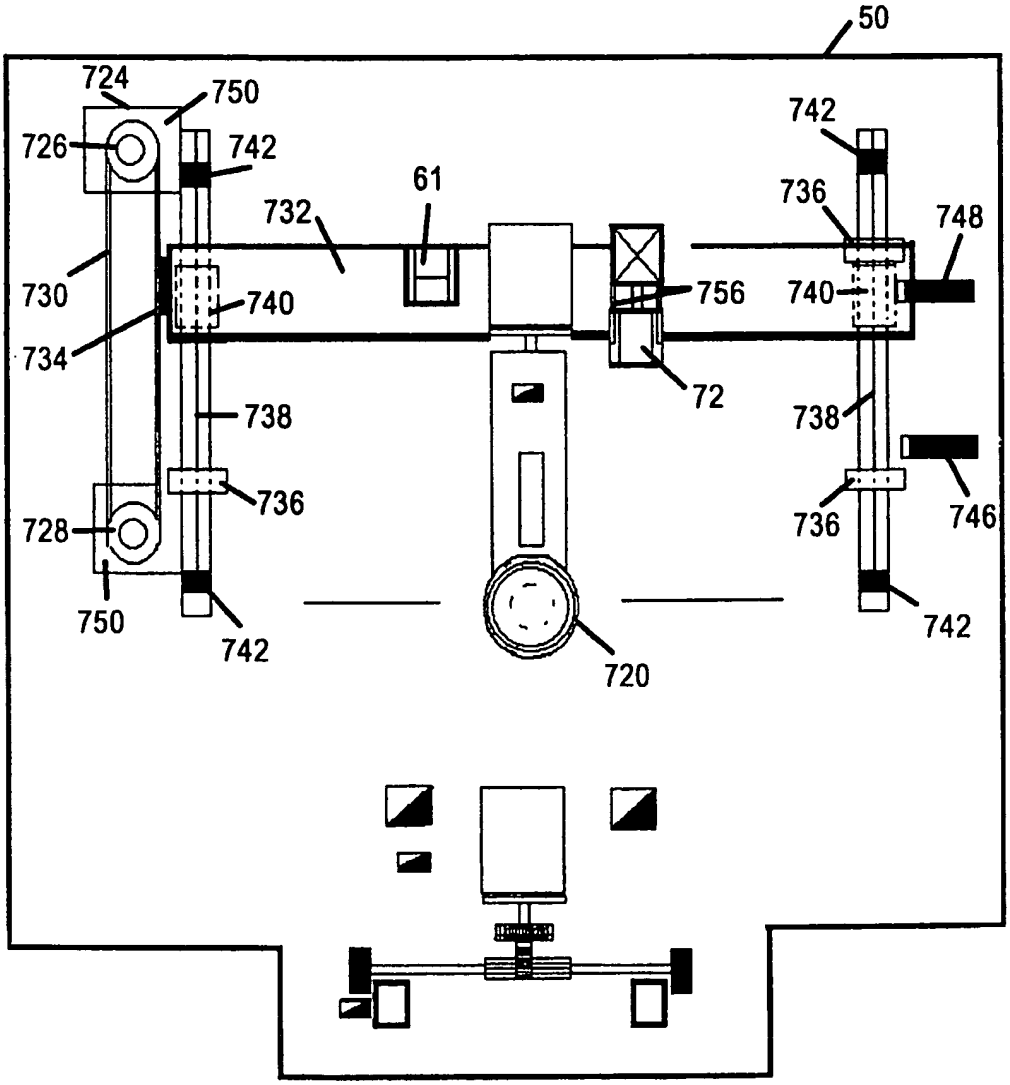
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FIGURE 8A

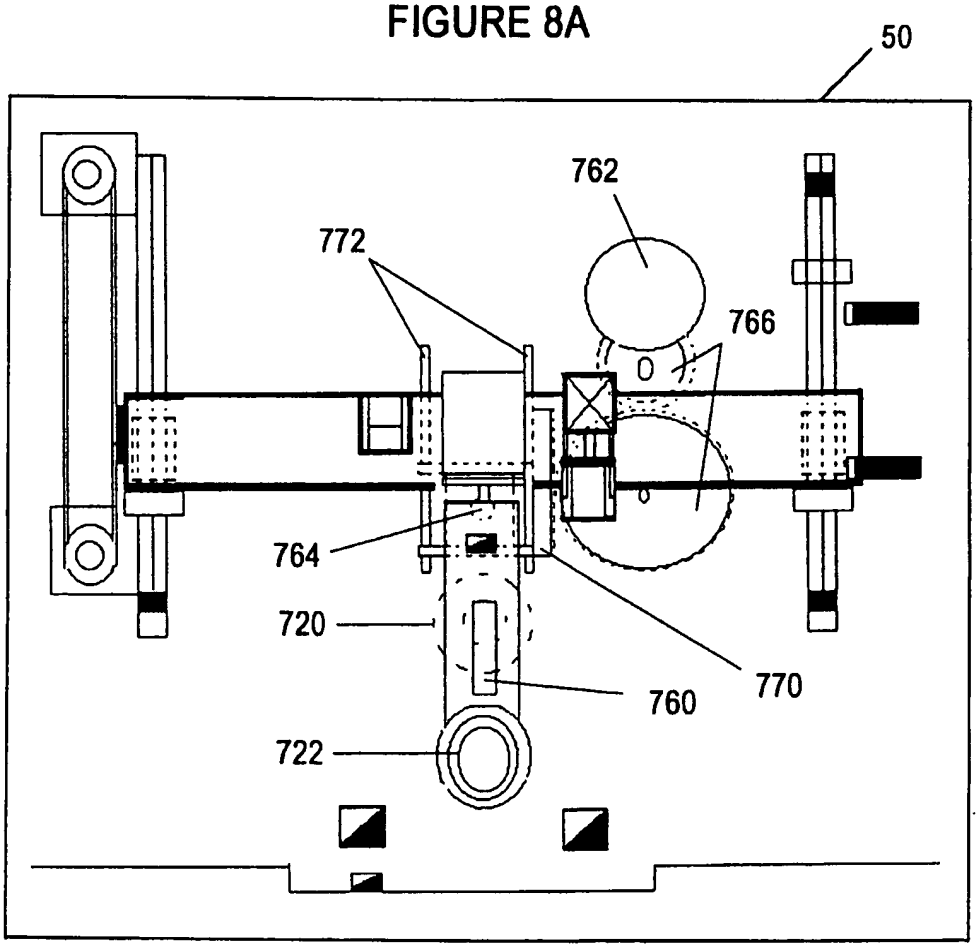


FIGURE 8B

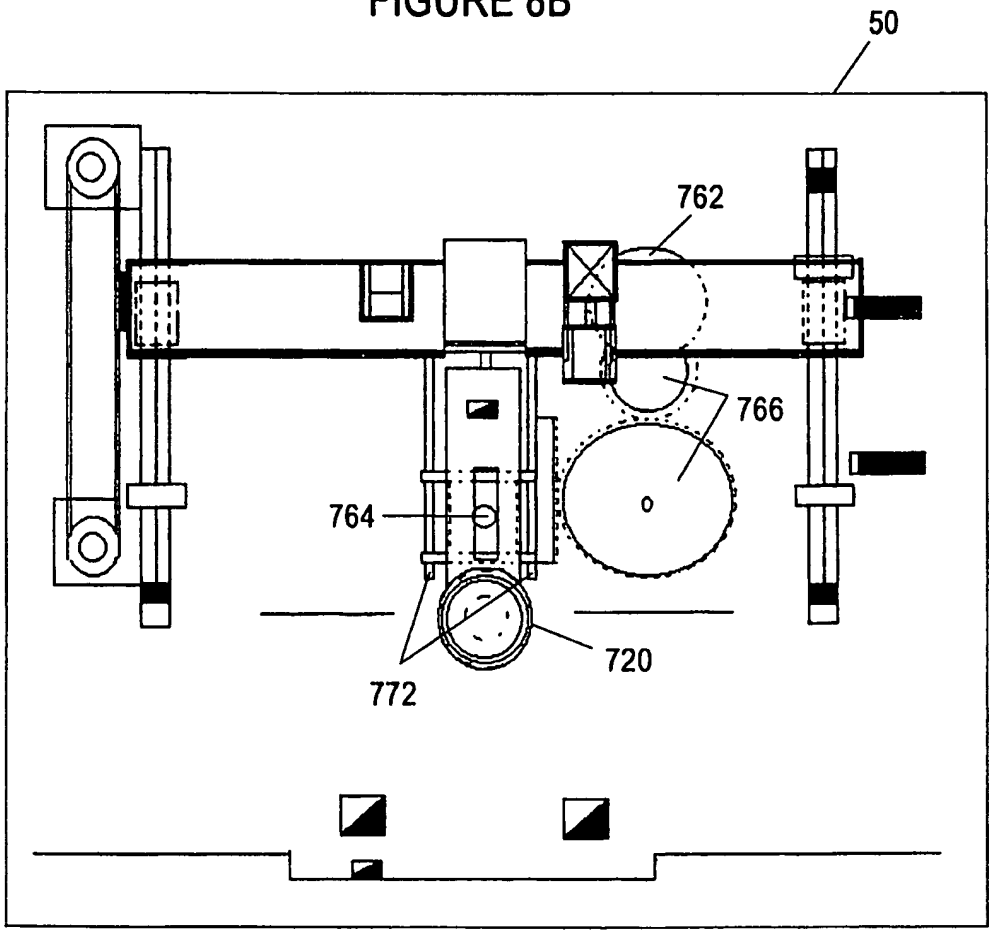


FIGURE 9A

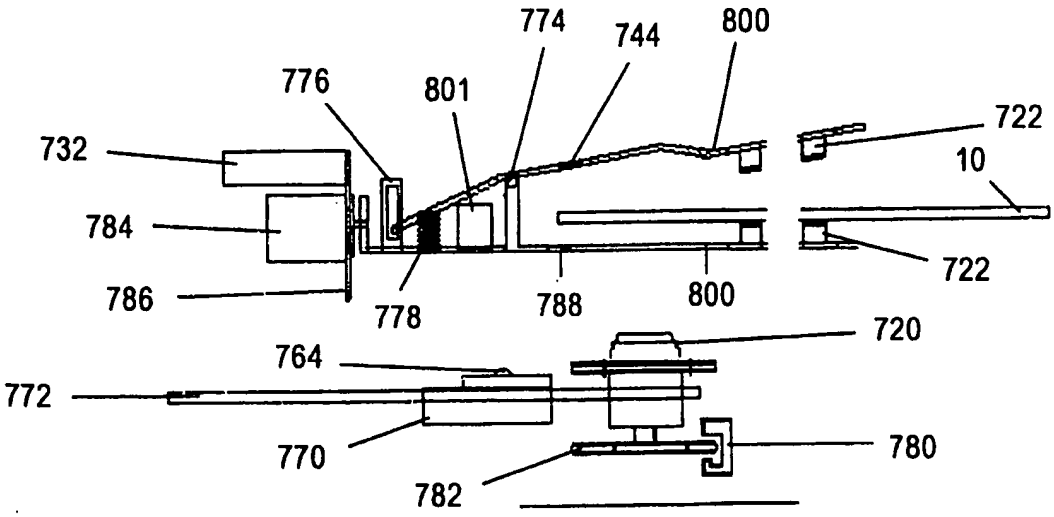


FIGURE 9B

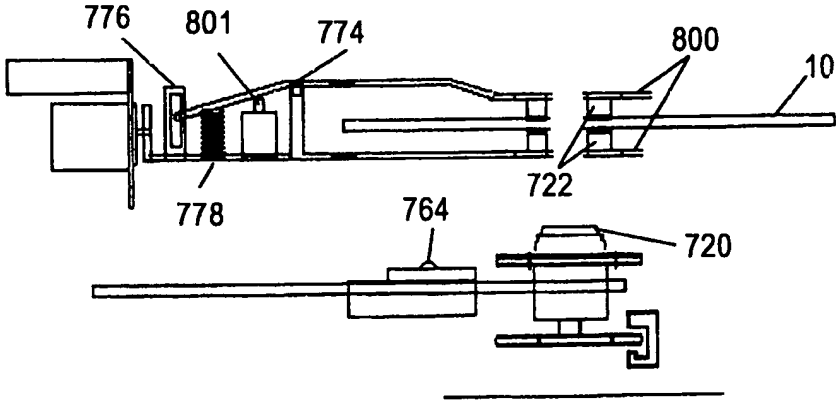


FIGURE 9C

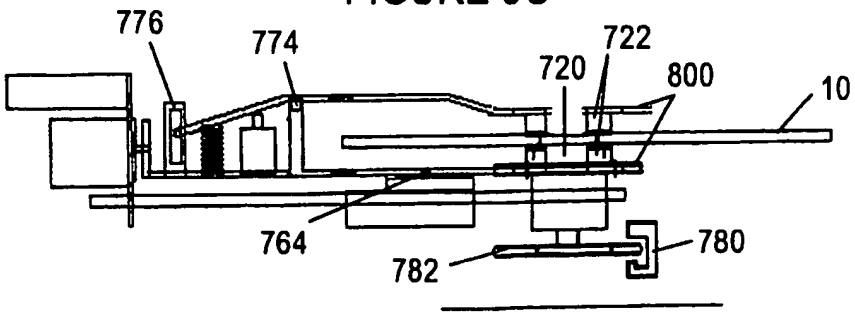


FIGURE 10A

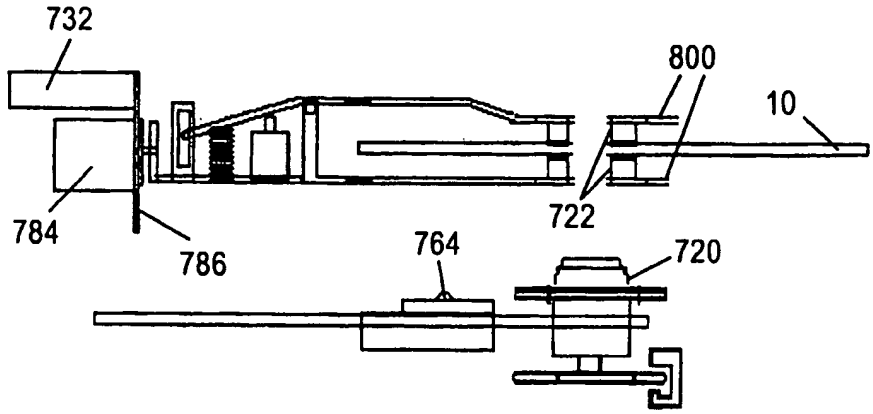


FIGURE 10B

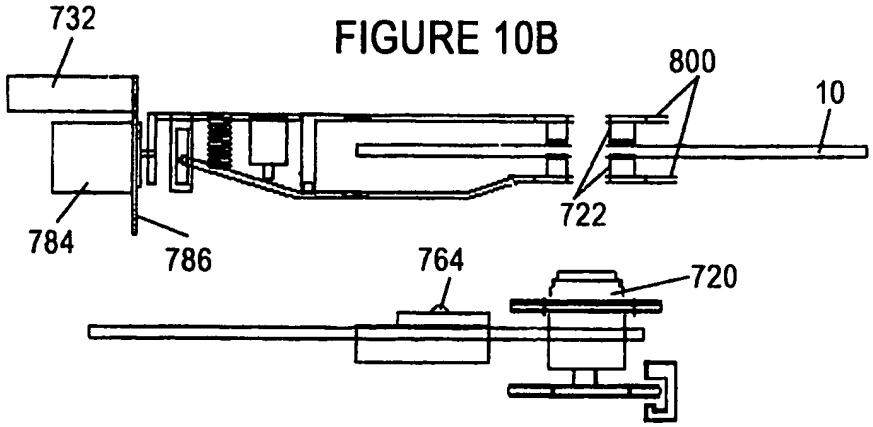


FIGURE 10C

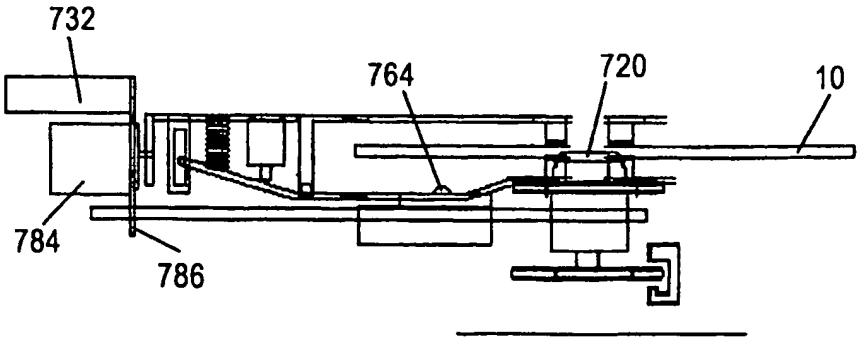


FIGURE 11A

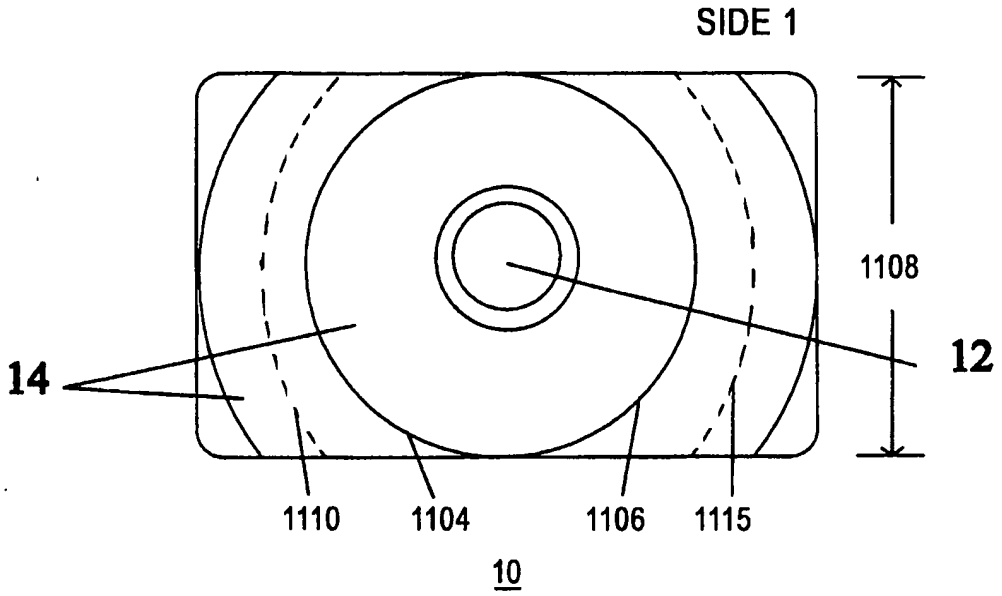


FIGURE 11B

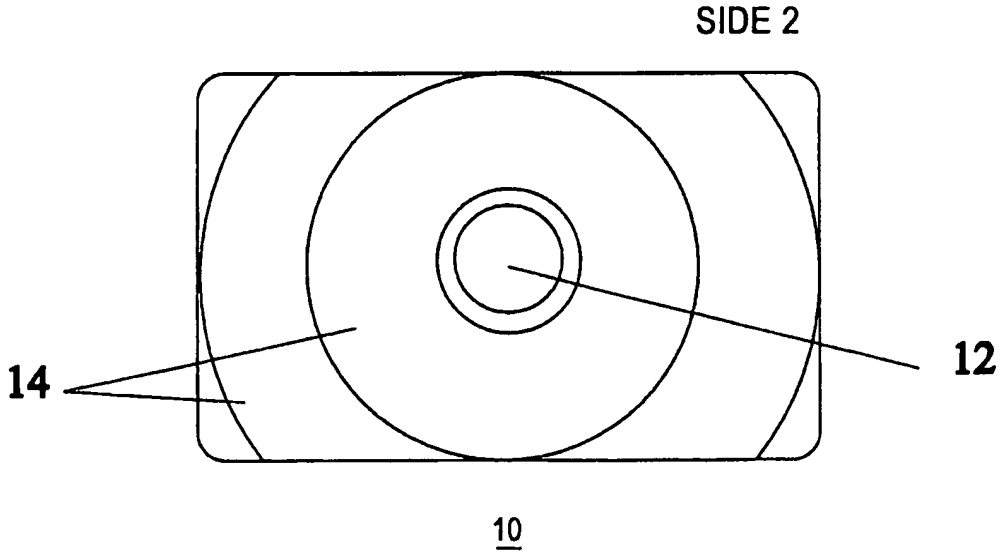


FIGURE 12A

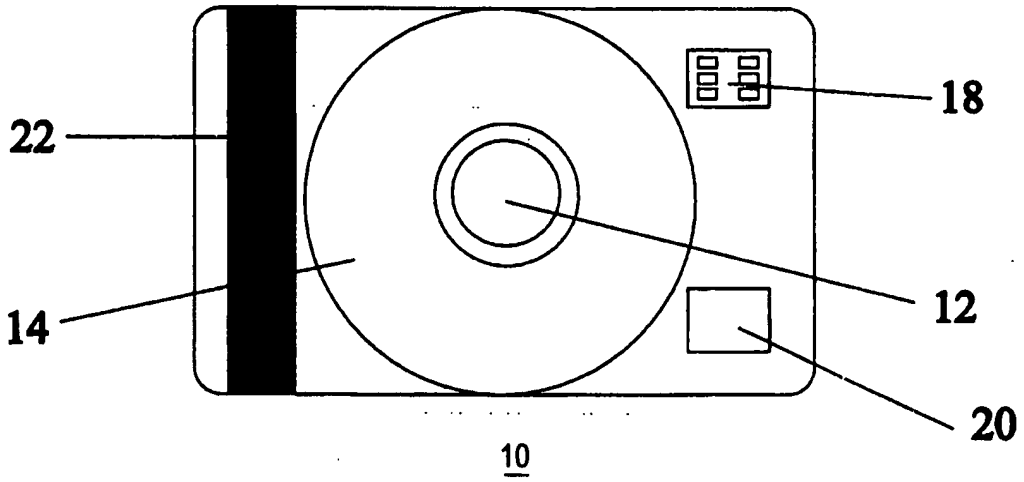
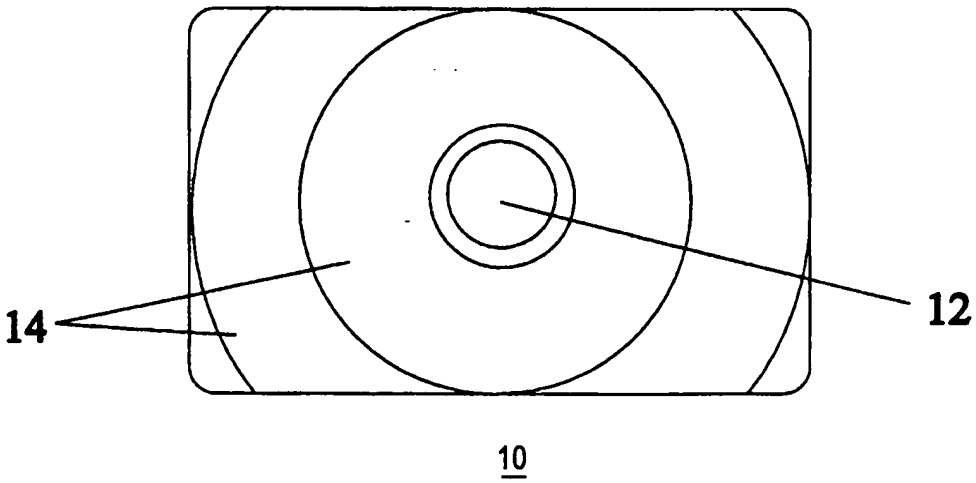


FIGURE 12B



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/27044

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :G11B 5/09, 17/22
US CL : 369/47.15, 33, 14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 369/47.15, 33, 14, 32, 41, 30, 59.1, 275.1, 275.3, 13, 53.2; 360/72.1, 72.2

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST search

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,872,151 A (SMITH et al) 03 October 1989, whole document	1-48

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 18 DECEMBER 2000	Date of mailing of the international search report 22 JAN 2001
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer ALI NEYZARI Telephone No. (703) 308-4906

Form PCT/ISA/210 (second sheet) (July 1998)*